TRANSMITTAL OF APPEAL BRIEF (Large Entity)	Docket No. ITO.0048US

In Re Application Of: **Stephen J. Hudgens**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/633,873	August 4, 2003	Ahmed N. Sefer	21906	2826	5270

Invention: **Processing Phase Change Material to Improve Programming Speed**

COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on **June 20, 2006**

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Dated: **July 21, 2006**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Applicant:	Stephen J. Hudgens	Art Unit:	2826
Serial No.:	10/633,873	Examiner:	Ahmed N. Sefer
Filed:	August 4, 2003	Atty Docket:	ITO.0048US (P16245)
For:	Processing Phase Change Material to Improve Programming Speed	Assignee:	Intel Corporation

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APPEAL BRIEF

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Nancy Meshkoff
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REAL PARTY IN INTEREST

The real party in interest is the assignee Intel Corporation.

RELATED APPEALS AND INTERFERENCES

None.

STATUS OF CLAIMS

Claims 1-10 (Withdrawn).

Claims 11-25 (Rejected).

Claims 26-30 (Withdrawn).

Claims 11-25 are rejected and are the subject of this Appeal Brief.

STATUS OF AMENDMENTS

All amendments have been entered.

SUMMARY OF CLAIMED SUBJECT MATTER

In the following discussion, the independent claims are read on one of many possible embodiments without limiting the claims:

11. A phase change material comprising:

a chalcogenide (Figure 1, element 24);

a species introduced into the chalcogenide material to reduce grain size (Specification at page 3, lines 6-16); and

a species introduced into the chalcogenide to increase crystallization speed (Specification at page 4, lines 11-23).

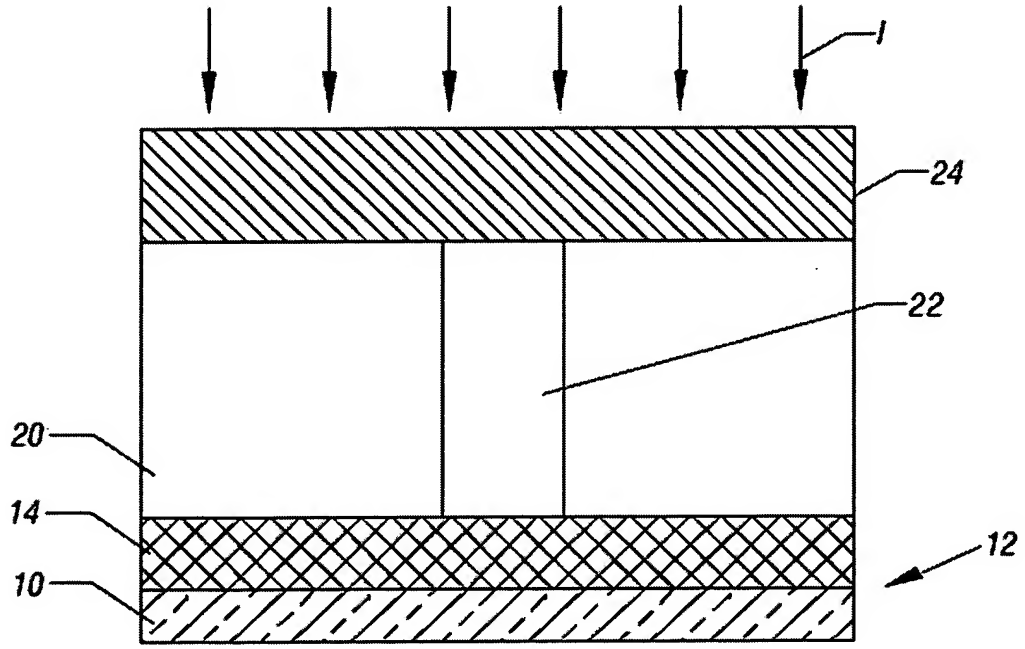

FIG. 1

16. A device comprising:

a substrate (Figure 1, 12); and

a layer of chalcogenide material (Figure 1, 24) over said substrate, said chalcogenide material including a species to reduce the grain size of the chalcogenide material and a species to increase the crystallization speed of said chalcogenide material (Specification at page 3, lines 6-16 and page 4, lines 11-23).

At this point, no issue has been raised that would suggest that the words in the claims have any meaning other than their ordinary meanings. Nothing in this section should be taken as an indication that any claim term has a meaning other than its ordinary meaning.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Are claims 11, 12, 14, and 15 anticipated by Sato?

B. Are claims 11, 12, 14, and 15 anticipated by Horie?

C. Are claims 16, 17, and 19-22 anticipated by Sato?

D. Are claims 16, 17, 19, and 21-25 anticipated by Horie?

E. Are claims 13 and 18 unpatentable over Sato/Horie?

ARGUMENT

A. Are claims 11, 12, 14, and 15 anticipated by Sato?

The premise of the rejection is apparently to hold that the requirements of claim 11 "to reduce grain size" and "to increase crystallization speed" are ineffective limitations because they are functional. To the contrary, functional limitations can be effective where they define the corresponding structure. See M.P.E.P. § 2173.05(g), citing *In re Venezia*. In other words, the claims, as currently pending in the application, define the chalcogenide material as having a species and that species is defined as being one which reduces grain size or one which increases crystallization speed. Therefore, the claims define the species that dope the material to achieve the asserted function.

Nothing in the reference in any way suggests the claimed combination.

For example, based on a review of the Patent Office supplied translation of Sato, it is clear that crystallization speed is only adjusted by engineering thermal coefficients, not by any kind of introduced species. The reference to a titanium alloy on page 3 of 6 of the translation is with respect to the film 5, not to the chalcogenide containing film. Clearly, the chalcogenide film is 3 and the reflective film 5 is spaced from that film. Therefore, there is no species introduced into the chalcogenide film to increase crystallization speed. Instead, as explained in paragraph 25 of that reference, the difference in coefficient of thermal expansion controls the crystallization process.

An important disadvantage of the nitrogen doped micrograin chalcogenide is a reduction in crystallization speed compared to undoped chalcogenide. This causes an unfavorable tradeoff of programming current and programming speed. Since programming to the set state already requires the longest programming pulse in undoped chalcogenide, further increasing the length of the set pulse with nitrogen doped micrograin chalcogenide can result in greater energy required for the programming pulse, even though the programming current is reduced. In battery operated portable electronic equipment, programming energy is more important than programming current since this directly impacts battery use life.

The claimed invention solves this problem by providing a means of accelerating crystallization speed while maintaining all the advantages of grain refinement in conventional nitrogen doped micrograin chalcogenide. Embodiments use simultaneous doping of nitrogen

doped micrograin chalcogenide with titanium which reduces the set time of a conventional chalcogenide alloy. As shown in Figure 4, devices with 400 Angstrom chalcogenide layers deposited on 10 to 20 Angstrom titanium layers exhibit increases of set speed greater than five times. See the specification at page 6, line 25, through page 7, line 8.

In paragraph 3 of the response to arguments, it is suggested that the *In re Venezia* case is in someway limited to situations arising under 35 U.S.C. § 112. There is no basis for this interpretation of the case. Moreover, it ignores the corresponding language in the cited Manual of Patent Examining Procedure. See M.P.E.P. § 2173.05(g).

The assertion that applying titanium to layers other than the chalcogenide layer would increase crystallization speed is unsupported. The Examiner cannot simply make unsupported assertions of fact and leave it to the Applicant to disprove them. Here, there is nothing that would suggest that putting a material in one layer would affect the crystallization speed of another layer.

Therefore the rejection should be reversed.

B. Are claims 11, 12, 14, and 15 anticipated by Horie?

With respect to Horie, it is suggested that Horie teaches a titanium film being introduced into a chalcogenide film. In support, Figure 4 is cited. Nothing in Figure 4 suggests any such thing. Also, paragraph 194 is cited. Significantly, paragraph 194 never even mentions titanium. Also, paragraph 77 is cited. Significantly, paragraph 77 never even mentions titanium.

The cited reference to Horie teaches titanium, but he uses titanium in the reflective layer as well. As shown in Figures 1A and 1B, the reflective layer is spaced from and different than the recording layer. It is the recording layer that includes the chalcogenide material. The chalcogenide material is 3 and the material with titanium is 2. Thus, it is clear that the chalcogenide does not have a species introduced into the chalcogenide material to reduce grain size.

The discussion at paragraph 77, cited in the office action, is with respect to the element M1. Paragraph 77 speaks of using a metal selected from a group including nitrogen to affect crystallization speed. But nothing in the patent application to Horie talks about a species introduced to the chalcogenide material to reduce grain size. Nothing is cited to support the assertion that there is a species introduced into the chalcogenide material to reduce grain size and

the only instance where titanium is discussed is believed to be in reference to reflective material, not the chalcogenide material. See paragraph 137. Therefore, the rejection of claims based on Horie should be reversed.

C. Are claims 16, 17, and 19-22 anticipated by Sato?

For the reasons set forth in Section A, above, the rejection should be reversed.

D. Are claims 16, 17, 19, and 21-25 anticipated by Horie?

For the reasons set forth in Section B, above, the rejection should be reversed.

E. Are claims 13 and 18 unpatentable over Sato/Horie?

These claims require that the grain size be reduced below 10 nanometers. Thus the claims are not subject to the improper functional limitation rejection. Nothing in the prior art teaches reduced grain size in general, much less the claimed grain size reduction.

Therefore, the rejection should be reversed.

Applicant respectfully requests that each of the final rejections be reversed and that the claims subject to this Appeal be allowed to issue.

Respectfully submitted,

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CLAIMS APPENDIX

The claims on appeal are:

11. A phase change material comprising:
a chalcogenide;
a species introduced into the chalcogenide material to reduce grain size; and
a species introduced into the chalcogenide to increase crystallization speed.

12. The material of claim 11 wherein said chalcogenide includes $Ge_2Sb_2Te_5$.

13. The material of claim 11 wherein the grains of the chalcogenide are less than approximately 10 nanometers.

14. The material of claim 11 wherein the species to reduce grain size includes nitrogen.

15. The material of claim 11 wherein the species to increase crystallization speed includes titanium.

16. A device comprising:
a substrate; and
a layer of chalcogenide material over said substrate, said chalcogenide material including a species to reduce the grain size of the chalcogenide material and a species to increase the crystallization speed of said chalcogenide material.

17. The device of claim 16 wherein said chalcogenide material includes $Ge_2Sb_2Te_5$.

18. The device of claim 16 wherein the grains of the chalcogenide material are less than approximately 10 nanometers.

19. The device of claim 16 wherein the species to reduce grain size includes nitrogen.

20. The device of claim 16 wherein the species to increase crystallization speed includes titanium.

21. The device of claim 16 wherein the device is a semiconductor memory.

22. The device of claim 16 including an insulator over said substrate and under said chalcogenide material.

23. The device of claim 22 including a heater extending through said insulator to said chalcogenide material to heat said chalcogenide material.

24. The device of claim 16 including titanium containing layer under said chalcogenide material.

25. The device of claim 24 wherein said titanium containing layer is sufficiently proximate to said chalcogenide material that titanium may diffuse into the phase change material upon heating.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.